Effect of cinnamon supplementation on blood glucose and lipid levels in type2 diabetic patients

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ABSTRACT

This study was planned to investigate the effects of supplementation of cinnamon on fasting blood glucose levels and lipid profiles among type2 diabetic patients. 60 subjects with type 2 diabetes from both sexes (30 males and 30 females) were allocated to the intervention and control groups (30 individuals per group). The doses of 1.5 g of cinnamon were equally administered orally in the form of cinnamon powder into 500 mg per capsule with breakfast, lunch, and dinner for 60 days. Control group received capsules of containing placebo. Blood samples were obtained on the beginning day of the experiment and at the end of 60 days. The fasting blood glucose levels and lipid profiles including total cholesterol, LDL-C, HDL-C and triglycerides of types 2 subjects were measured. Fasting blood glucose levels and lipid profiles in intervention group were significantly lower than control group ($p<0.05$). The average of fasting blood glucose levels, total cholesterol, cholesterol LDL and triglyceride levels were decreased after consumption of cinnamon powder, significantly($p<0.05$). We observed no significant changes in fasting blood glucose levels and lipid profiles after consumption of placebo in control group. Conclusion: This study showed that consumption of cinnamon supplementation may be useful in control and decreasing of fasting blood glucose levels and lipid profiles among type 2 diabetes individuals.

Keywords: Cinnamon; Fasting blood glucose; Lipid profiles; Diabetes

INTRODUCTION

Diabetes is the most common endocrine disease and it is still a serious health problem all over the world. Approximately 3 million individuals suffer from diabetes in Iran. The prevalence of diabetes in Iran is similar to some other developed countries (Alberti et al., 1998). The cause of type 2 diabetes is multifactor. Diet can play a major role in the incidence and progression of the disease (Carter et al., 1996). Drug treatment and dietary interventions are known to be effective tools to prevent type 2 diabetes (Willett et al., 2002: Jenkins et al., 2002). Disorder of glucose metabolism resulting from dysfunction of pancreatic beta cells and insulin resistance is seen in diabetes mellitus. Medicinal herbs are expected to have a similar degree of efficacy without the troublesome side effects associated with conventional drug treatment. Currently, there is growing interest in herbal remedies due to the side effects associated with the therapeutic agents (oral hypoglycemic agents and insulin) for the treatment of diabetes mellitus (Holman and Turner, 1991; Kameswara Rao et al., 1997). Spices and some herbs are sources of many effective antioxidants. Herbal products can improve glucose metabolism in diabetic individuals not only by having hypoglycemic effect, but also by improving lipid metabolism, antioxidant status, and capillary function (Broadhurst., 1997). Most of the cinnamon extracts are safe and having little side effects, it is also possesses anti-diabetic property (Broadhurst *et al*., 2000). Cinnamon has many pharmacological properties, such as antioxidants activity, antibacterial effects, natural insulin sensitizer (Lopez et al., 2005), and bioactive product that improve glucose and insulin metabolism (Khan et al., 1990; Broadhurst., et al 2000) and it is useful for treatment of type2 diabetetic patients (Khan et al., 1990). Several in vitro and in vivo studies have shown cinnamon's effect on insulin signal transduction (Karalee et al., 2001; Lee et al., 2003; Qin et al., 2003; Qin et al., 2004; Imparl-Radosevich et al., 1998).. Cinnamon lowered blood glucose, total cholesterol, and triglyceride levels in diabetic mice (Kim et al.,

2006). Administered of 1, 3 and 6 doses of cinnamon powder (*Cinnamomum cassia*) for over 40 days, were equally effective on reducing mean fasting serum glucose, triglyceride, LDL cholesterol, and total cholesterol levels (Khan et al., 2003). Other study evaluated the effects of 1 g cinnamon daily for 3 months in diabetic populations and no significant changes was observed in levels of fasting glucose, total cholesterol, LDL cholesterol and HDL cholesterol as well as triglycerides, glycosylated hemoglobin and insulin (Blevinsn et al., 2007). The aim of this study was to evaluate the effect of supplementation of cinnamon powder on fasting blood glucose levels and lipid profiles among type2 diabetic patients.

MATERIALS AND METHODS

This double blind clinical trial study was conducted in Endocrinology and Diabetes Clinic of Tabriz University of Medical Sciences, in Iran in 2010. The study was approved by Medical Ethical Committee of the Tabriz University and also recorded by the identification code of IRCT138811133253N1 in clinical trials registry of Iran. 80 subjects were selected based on entry and exit criteria of study and medical records. Inclusion criteria were: 1) type 2 diabetic individuals suffering over 4 years, 2) fasting blood glucose range of 160-400 mg/dl, and 3) age of patients between 40-60 years old. Exclusion criteria were 1) patients with kidney, liver, parathyroid, and gastrointestinal diseases, 2) patients of pregnancy and breastfeeding, using insulin therapy and glycosylated hemoglobin less than 7 mg/dl. After an interview, 60 people declared consent to participate in the study. The selected individuals were randomly assigned into two groups; study and control groups (30 in each group) and followed for 60 days. The treatment was performed for 8 weeks. All participants were allowed to take their routine diet, physical activity levels and usual diabetic medicine until the end of the study. This study did not suggest any changes in subject's medical care, diet, or exercise. The individuals were told to take 3 capsules, each containing (500mg) 1.5g of whole cinnamon powder, immediately after meals (breakfast, lunch and dinner) for 8 weeks. Control group intake of placebo. Anthropometric parameters including height, weight and body mass index (BMI) at the beginning and end of the study were measured. BMI was calculated using the data recorded for height and weight. Venous blood samples were taken for measurement of fasting blood glucose levels, lipid profiles, including triglycerides, total cholesterol, HDL and LDL cholesterol at beginning and the end of 8 weeks. Fasting blood glucose levels and lipid profiles were measured two times once at baseline before cinnamon intake and the second measured after cinnamon intake for 60 days. Triglycerides and total cholesterol were measure using enzymatic kits (BioSystems Spain), and HDL and LDL cholesterol were measured using photometric method test and devices autoanalyzer Pars (Hitachi 911, Japan). All data as mean ± SD were presented. Paired sample t-test and Independent sample t-test were used for data analysis. Statistically significant level for all tests $P<0/05$ was considered.

RESULTS

Of 80 individuals with type 2 diabetes who visited the research center, 20 were excluded (18 had various illnesses and 2 due to lack of cooperation). The remaining 60 were randomized. In the starting of study, there were no significant differences of BMI and other biochemical factors between the cinnamon and control groups. The mean of age in cinnamon group and placebo group was 59.1±12.1 and 54.6 ±13.1 years, respectively. 50% of the participants were male and 50% comprised women. There were no significant weight, BMI and HDL between two groups after intervention. Fasting blood glucose levels and lipid profiles including total cholesterol, cholesterol LDL and triglyceride levels in cinnamon group were decreased in compared to control group, significantly ($p<0.05$) (table 1). There were no significant changes in BMI, weight and HDL in the subjects after consuming of cinnamon and placebo (table 1). The mean of fasting glucose levels, total cholesterol, cholesterol LDL and triglyceride levels declined at the end of 8 weeks in comparison of the beginning day before cinnamon intake, significantly ($p<0.05$) (table 2). We observed no significant changes in fasting blood glucose levels and lipid profiles after consumption of placebo in control group (table 3).

Table1. The comparison of anthropometric measurements and biochemical factors in two groups after intervention

Variables	Cinnamon group	Control group	P value
	Mean ± SD	Mean ± SD	
Weight(kg)	78 ± 18	77 ± 8	> o.5
BMI(kg/m^2)	28 ± 4	29 ± 7	> o.5
Fasting blood glucose (mg/dl)	141.1 ± 10	172.6 ± 11	< 0.5*
total cholesterol (mg/dl)	136.7 ± 6.5	184 ± 9.5	< 0.5*
triglyceride levels (mg/dl)	122.8 ± 11.5	175.4 ± 16.4	< 0.5*
LDL (mg/dl)	89 ± 5.6	105.6 ± 7.1	< 0.5*
HDL (mg/dl)	43.1 ± 1.3	46.5 ± 1	> o.5

Data are mean ± Standard deviation.
*Different is significant at the 0.05 level

Table2. The comparison of anthropometric measurements and biochemical factors in baseline and after intervention in cinnamon group

Variables	Baseline	End 8 weeks	P value
Weight(kg)	77 ± 17	78 ± 8	> 0.05
BMI(kg/m^2)	29 ± 3	28 ± 4	> 0.05
Fasting blood glucose (mg/dl)	169 ± 12	141.1 ± 10	< 0.05
total cholesterol (mg/dl)	175.3 ± 8.3	136.7 ± 6.5	< 0.05
triglyceride levels (mg/dl)	165.5 ± 15.5	122.8 ± 11.5	< 0.05
LDL (mg/dl)	100.5 ± 6.6	89 ± 5.6	< 0.05
HDL (mg/dl)	42.2 ± 1.7	43.1 ± 1.3	> 0.05

Data are means ± Standard deviation
*Different is significant at the 0.05 level

Table 3. The comparison of anthropometric measurements and biochemical factors in baseline and end 8 weeks in control group

Variables	Baseline	End 8 weeks	P value
Weight(kg)	78 ± 8	77 ± 8	NS
BMI(kg/m^2)	29 ± 7	29 ± 7	NS
Fasting blood glucose (mg/dl)	174 ± 12.3	172.6 ± 11	NS
total cholesterol (mg/dl)	181.6 ± 8.3	184 ± 9.5	NS
triglyceride levels (mg/dl)	172.3 ± 16.1	175.4 ± 16.4	NS
LDL (mg/dl)	104 ± 7	105.6 ± 7.1	NS
HDL (mg/dl)	46 ± 1.5	46.5 ± 1	NS

Data are means ± Standard deviation
NS= non significant

DISCUSSION

Our study indicates that 1.5g of cinnamon supplementation for 8 weeks improve fasting blood glucose levels and lipid profiles in type2 diabetic patients. A number of plant species have been described as hypoglycaemic, and they are beneficial in treating elevated fasting blood sugar [8]. In *vitro* and in *vivo* data were showed cinnamon have supporting the role of on glycemic control [19]. In study of Khan *et al.* was showed that cinnamon consumption in doses of 1, 3, or 6 g daily for a period of 40 days led to a major reduction in fasting blood glucose, triglyceride, LDL, and total cholesterol levels [17]. We found significant reduction fasting blood glucose, triglyceride, LDL, and total cholesterol levels, which seemed small amounts of cinnamon likely represent a safe and control risk factors of diabetic patients. Reduction of biochemical parameters after cinnamon intake might be related to an unidentified factor present in cinnamon that potentiates the action of insulin in carbohydrate metabolism. Polyphenolic polymers found in cinnamon may function as antioxidants, potentiate insulin action, and

may be useful in the control of glucose intolerance and diabetes [20]. In study of Broadhurst, et al recognized the presence of this factor in cinnamon. This unidentified factor improved the activity of insulin 3 fold in glucose metabolism in rat [8]. Other study reported methylehydroxy chalcone polymers (MHCP) as the unidentified factor in cinnamon. MHCP make fat cells more reactive to insulin by activating the enzyme that causes insulin to join to cells (insulin-receptorkinase) and inhibiting the enzyme that blocks this progression (insulin-receptor-phosphatase) leading to maximal phosphorylation of the insulin receptor, which is related to increased insulin sensitivity[19]. Ziegenfuss *et al* indicated consumption of water-soluble cinnamon extract that was equivalent to 3 g/day of whole cinnamon powder for 12-weeks leads to significant improvements in fasting blood sugar [21]. This study is different from the trial of Vanschoonbeek et al. They reported no effect of 1.5 g/d for 6 weeks cinnamon powder on indices of glycemic control in 25 postmenopausal women from the Netherlands [22]. This study showed that cinnamon supplementation is effective in reduction fasting blood glucose levels and some lipid profiles among type2 diabetic patients. This research demonstrate positive effect of cinnamon supplementation on decreasing fasting blood glucose levels and modulate the blood lipid profiles, therefore, we conclude that the proposed health benefits of cinnamon supplementation in type2 diabetic patients could improve some of biochemical factor levels. Small amounts of cinnamon possible represent a safe and effective means to reduce the risk factors associated with type2 diabetic patients. If diabetes patients apply cinnamon in their food preparations regularly, they may keep their fasting blood sugar levels and lipid profiles near to normal levels.

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